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DESCRIPTION OF RECENT GAMING

Games run

Game 1a. 1981-1990

- *New Assets controlled entirely by Projects*
  - Joint Point of Diversion
  - Delta Mendota Canal/ California Aqueduct Intertie
  - Limited expansion of Banks pumping limits
  - Option to purchase 100 kaf in first two years of drought
  - Demand shift option of 60 kaf.
- *Fish agencies meet fish needs within b(2) budget + E/I relaxations.*

Game 1b. 1981- 1990.

- *New Assets controlled entirely by Projects*
  - Joint Point of Diversion
  - Delta Mendota Canal/ California Aqueduct Intertie
  - Full use of 10.3 kcfs at Banks
  - Option to purchase 100 kaf in first two years of drought
  - Demand shift option of 60 kaf
  - Expansion of Shasta by 290 kaf
  - Delta storage of 200 kaf
  - Groundwater storage of 500 kaf south of Delta.
- *Fish agencies meet fish needs within b(2) budget + E/I relaxations.*

Methodology

Each Year:

- *Equalize Initial Storages.* Set initial storages in Shasta, Oroville, Folsom, New Melones, and San Luis at carryover values from last year's Daily model for all DWRSIM and Daily Ops model runs. For first year, use initial storage from appropriate DWRSIM run.
- *Run DWRSIM for WQCP and D 1485.*
- *Calculate CVP Export Impacts from WQCP.* Total CVP impacts are derived by subtracting CVP D 1485 exports from WQCP exports. The b(2) cost is the lesser of the calculated impact or 450 kaf.
- *Run DWRSIM to create gaming baseline.*
  - DWRSIM run 3 approximates "beginning of Stage 1" conditions. It includes the JPOD, DMC/ CA Aqueduct intertie, and a slight expansion in Banks capacity. It does not include water purchases or demand shifting.
  - DWRSIM run 6 approximates "end of Stage 1" conditions. It includes the JPOD, DMC/ CA Aqueduct intertie, expanded Banks capacity, increased Shasta volume, and groundwater storage. It does not include water purchases, demand shifting, or Delta storage.
- *Run Daily Model.* The Daily model takes monthly tributary releases and Project deliveries from DWRSIM in run 3 or run 6 as input parameters. Monthly average releases are then converted into daily data, using historical flow fluctuations as a guide (while preserving total monthly flows). The Daily model then gives as output daily tributary flow and storage data, Delta inflows, Delta outflows, exports, Delta Island storage, San Luis Reservoir storage, salinity estimates, etc.
- *With Daily Model, Apply AFRP Flows, if Desired.* Release of water to meet AFRP flows is discretionary.
- *Subtract any AFRP costs from b(2).* Reservoir spills before February 1 erase b(2) AFRP costs from that tributary.
- *Reevaluate Exports.* Increase Delta inflows to reflect AFRP releases. Increased inflow in the fall frequently leads to increased exports.
- *Apply remaining b(2) water (if needed) to export reduction.* After subtracting out the WQCP and AFRP uses of b(2) the remaining b(2) is available for export reduction. VAMP export reductions were applied nearly every year and additional cuts were made as b(2) water was available.
- *Optimize Project Storage levels.* Occasionally water was shifted from upstream of the Delta into San Luis Reservoir to compensate for lowered storage.
- *Apply water purchase and demand shift tools, if needed.* If b(2) actions reduced San Luis storage below the Daily baseline level and appeared to cause to low point problem, then these tools were applied to support storage levels.
- *Reduce deliveries to contractors, if needed.* If additional storage in San Luis was still needed to regain the baseline Daily storage levels and avoid a low point problem, then delivery reductions were made.
- *Use final storage levels as inputs to next year of modeling.*

Qualifications

- *B(2) for Outflow.* USFWS never declared that upstream releases were required for Delta outflow in the games. If the had, exports would have dropped in some cases.
- *B(2) Water Using Section III.* Section III of the DOI b(2) decision allows DOI to transfer and bank B(2) water. This option was never exercised in the game.
- *B(2) Accounting methods.* The accounting used in the game is unlikely to match the accounting ultimately selected by DOI. In general, the accounting system assumed in the game was highly favorable to water exporters. In summary, b(2) was accounted for in the following ways:
  - The export impact attributable to b(2) was calculated each year as the difference in CVP exports between WQCP and D 1485 DWRSIM runs (with a maximum of 450 kaf) assuming regulations and infrastructure available in 1995. DOI is not using this exact method at present, but is attempting to calculate b(2) costs using its b(2) accounting methodology (change in storage from October through January, other upstream releases over the rest of the year, changes in exports). The decision whether to calculate b(2) costs using 1995 supply conditions or current conditions will become very important in the future. For example, the Joint Point of Diversion (JPOD) eliminates most of the WQCP impacts on the CVP. If JPOD is granted, should the assessments against b(2) for WQCP impacts be reduced? Or should the additional water go to increasing export supplies? This is a policy question.
  - Essentially all changes in CVP operations were charged to the b(2) account, even in circumstances where the operational changes did not affect future storage levels. For example, export reductions made before filling San Luis were charged to b(2), even though the changes had not effect on long-term storage or delivery patterns. In other words, no actions were consider to be b(1) actions.

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- Year to year changes in exports due to changed storage levels were not charged (or credited) to b(2). Rather, each year started fresh with a b(2) account of exactly 800 kaf and any water losses or gains resulting from actions taken in previous years were ignored. For example, b(2) actions in a particular year might not
- The gaming exercise used a static baseline. That is, "baseline" export patterns were determined once and for all in the initial run of the Daily model. Thereafter, only b(2) actions which pushed daily exports below these baseline values were charged to b(2). For example, export cuts in January might prolong the period during which the export pumps need to pump at full capacity to fill San Luis Reservoir. If the biologists then wish to cut these additional exports, they do not need to expend additional b(2) water, unless their cuts are large enough to push exports below the original (low) baseline. Static accounting is simply using simulations. It is much more difficult in real operations, when it is difficult to create a well defined (i.e., non b(2)) baseline.

- *Upstream Release Patterns.* The Daily model does not modify upstream release patterns in an attempt to optimize Delta operations. If the Daily model did optimize upstream operations, exports might rise somewhat. For example, b(2) export cuts might have allowed for reduced releases and greater storage upstream. This storage might have been exported at a later time, increasing exports.
- *DWRSIM exports vs Daily Model Exports.* Daily model exports are generally lower than DWRSIM exports by several hundred thousand acre-feet, even when average monthly inflows to the Delta are identical. This difference is caused by fluctuations in daily Delta inflow levels. Since DWRSIM average all flows over a month, it often makes exports that could not be made due to physical or regulatory limitations. Once CALSIM moves to a weekly timestep, this phenomenon should mostly disappear. As long as the models are used to estimate differences rather than absolve export values, this problem may not be significant. One implication of the difference in calculated exportable water between DWRSIM and the Daily model is that, in trying to meet DWRSIM generated deliveries, the Daily model will end each year with significantly less storage in San Luis. This is not caused by problems with the Daily model, but reflects the fact that DWRSIM frequently delivers more water than is justified. However, since results are to be presented in terms of DWRSIM yields, no attempt was made to correct the problem. Instead, the CT simply took enough actions each year (purchases, demand shifts, delivery reductions) to restore the same levels in San Luis Reservoir that were generated in the baseline Daily model run.
- *Perfect knowledge.* In games 1a and 1b, entire years were analyzed at a time. B(2) payments for the WQCP are calculated at the beginning of the year. This leads to an over optimized use of the remaining b(2) credits. In reality, USFWS would be faced each year with a need to hold back reserves of b(2) water in case of future need. However, an EWA account could reduce this problem by providing backup supplies, if needed.
- *Efficiency asset.* Water efficiency was not credited to either water user or EWA supplies in game 1b. If efficiency were added, the game would have shown a higher level of supply and/or ecosystem performance.
- *CVP/SWP interactions.* Gaming assumed complete sharing between CVP and SWP systems, including San Luis storage. In some cases, spring b(2) cutbacks may have exhausted CVP storage in SLR and required borrowing SWP storage. Policymakers must decide whether such operations are realistic. If borrowing of SWP storage is not allowed, then the ability to apply b(2) export cuts may be somewhat limited.

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